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Indian Standard

GLOSSARY OF TERMS RELATING TO
RIVER VALLEY PROJECTS

PART 6 RESERVOIRS

(First Revision)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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*Indian Standard*GLOSSARY OF TERMS RELATING TO
RIVER VALLEY PROJECTS

PART 6 RESERVOIRS

(First Revision)

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RIVER VALLEY PROJECTS

PART 6 RESERVOIRS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 November 1983, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A number of Indian Standards have already been published covering various aspects of River Valley Projects and a large number of similar standards are in the process of formulation. These standards include technical terms and precise definitions of terms which are required to avoid ambiguity in their interpretation. To achieve this end, the Sectional Committee on Terminology Relating to River Valley Projects is bringing out 'Glossary of terms relating to River Valley Projects' which is being published in parts. This (Part VI) contains definitions of terms relating to reservoirs and to its various components.

0.3 This standard was first published in 1968. The revision of the standard has been taken up in the light of the experience gained during the last few years in the use of this standard. Some terms have been modified.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

UNITED NATIONS. ECONOMIC COMMISSION FOR ASIA
AND THE FAR EAST. Glossary of hydrologic terms used in
Asia and Far East. 1956. Bangkok

INDIA. INTERNATIONAL COMMISSION ON IRRIGATION
AND DRAINAGE. Multilingual technical dictionary in
irrigation and drainage. 1967.

INDIA. CENTRAL BOARD OF IRRIGATION AND POWER.

Glossary of irrigation and hydro-electric terms and standard notations used in India. 1954. Manager of Publications, Delhi.

Nomenclature for hydraulics. 1962, American Society of Civil Engineers. New York.

0.4.1 All the definitions taken from 'Multilingual technical dictionary on irrigation and drainage' are acknowledged by asterisk (*) in the standard.

1. SCOPE

1.1 This standard (Part 6) contains definitions of terms relating to the various types of reservoirs, storage and sedimentation in reservoirs and evaporation losses from reservoirs, but does not contain definitions of terms relating to sub-surface or ground water reservoirs.

2. RESERVOIRS

2.1 A pond, lake, basin or other space, either natural in its origin or created in whole or in part by building of engineering structures, which issued for storage, regulation and control of water. Small reservoirs are also called tanks.

3. TYPES OF RESERVOIRS

3.1 Auxiliary or Compensatory Reservoir — A reservoir which supplements and absorbs the spill of a main reservoir.

3.2 Balancing Reservoir — A reservoir down stream of (or subsidiary to) the main reservoir for holding water let down from the main reservoir in excess of that required for irrigation, power generation or other purposes.

3.3 Conservation Reservoir/Conservation Storage Capacity — A reservoir impounding water for useful purposes, such as irrigation, power generation, recreation, domestic, industrial and municipal supply, etc.

3.4 Detention Reservoir — A reservoir wherein water is stored for a relatively brief period of time, part of it being retained until the stream can safely carry the ordinary flow plus the released water. Such reservoirs usually have outlets without control gates and are used for flood regulation; also called ' Flood Control Reservoir ' or ' Retarding Reservoir '.

3.5 Distribution Reservoir — A reservoir connected with distribution system of a water supply project, used primarily to care for fluctuations in demand which occur over short periods and also as local storage in case of emergency. (Such as a break in a main supply line failure of pumping plant.)

3.6 Flood Control Reservoir — See 3.4.

3.7 Grit Reservoir — A reservoir used for storage of turbid water for the purpose of sedimentation, also called 'Settling Reservoir' or 'Siltng Reservoir'.

3.8 Impounding Reservoir — A reservoir with gate-controlled outlets wherein surface water may be retained for a considerable period of time and released for use at a time when the normal flow of the stream is insufficient to satisfy requirements; also called 'Storage Reservoir'.

3.9 Multipurpose Reservoir — A reservoir constructed and equipped to provide storage and release of water for two or more purposes such as irrigation, flood control, power generation, navigation, pollution abatement, domestic and industrial water supply, fish culture and recreation; also called 'Multiuse Reservoir'.

3.10 Multiuse Reservoir — See 3.9.

3.11 Natural Reservoirs — Reservoirs created by natural means. Also called 'Lakes'.

3.12 Retarding Reservoir — See 3.4.

3.13 Settling Reservoir — See 3.7.

3.14 Silting Reservoir — See 3.7.

3.15 Storage Reservoir — See 3.8.

4. TERMS RELATING TO STORAGE IN RESERVOIRS

4.1 Active Capacity — The storage available for project purpose, usually the storage between the lowest allowable level of release (minimum draw down level) and the highest controlled water surface (static full pool level); also called 'Effective Capacity' or 'Useful Capacity', 'Active Storage Capacity', 'Effective Storage Capacity', 'Useful Storage Capacity' or 'Usable Storage Capacity'. The active capacity is thus the difference of gross storage capacity and the sum of dead storage capacity and inactive capacity.

4.1.1 Active Power Storage Capacity/Effective Power Storage Capacity — It is the storage capacity available for hydro power generation and is the difference of gross storage capacity and the sum of dead storage capacity and inactive capacity for hydro power generation.

4.2 Annual Storage*/Within the Year Storage — The difference between the maximum and minimum volumes in storage in a reservoir over a year of reservoir operation.

4.3 Bank Storage — Water absorbed and stored in the bed and banks of a stream, lake or reservoir, and returned in whole or in part as the level of the surface of the water body falls.

4.4 Capacity/Storage Capacity — Space available in a reservoir between specified levels whether actually occupied by water or empty.

4.5 Carry-over Storage* — Storage collected during surplus years for making up deficiencies in dry or lean year. It is the minimum storage during the year over and above the inactive storage capacity usable for the relevant purpose. Also called 'Over-Year Storage'.

4.6 Coefficient of Storage — A coefficient to express the relation of live storage capacity in a reservoir, to the mean annual inflow in the reservoir; also called 'Reservoir Factor'. When expressed as percentage it is also termed, 'Tank Percentage'.

4.7 Conservation Storage Capacity

- 1) Water impounded for release purposes, such as domestic and industrial supply, power generation and irrigation.
- 2) Capacity between the highest of the various minimum draw down level and the top of conservation pool.

4.8 Controlled Storage Capacity — Reservoir storage capacity subject to control by operation of gates or other control devices is the capacity available between dead storage level and highest controlled water level.

4.9 Dead Storage — Storage of a reservoir not susceptible to release by the in-built outlet means.

4.10 Effective Capacity/Effective Storage Capacity — See 4.1.

4.11 Elevation Area Capacity Curve — The graphs of area of water spread and the storage volume of reservoir each as function of assumed horizontal water surface with the water spread at specified reference time (see Fig. 1).

4.12 Flood Control Storage Capacity/Exclusive Flood Control Storage Capacity — Capacity reserved for storage of water during floods to be released later. This represents the capacity between top of conservation pool and to the highest controlled level. Also called 'Effective Flood Control Storage'.

4.13 Flowage Line — A reservoir contour corresponding to a definite water level (maximum, mean, low, spillway, crest, etc) generally used in connection with acquisition of rights to flood land for storage purposes.

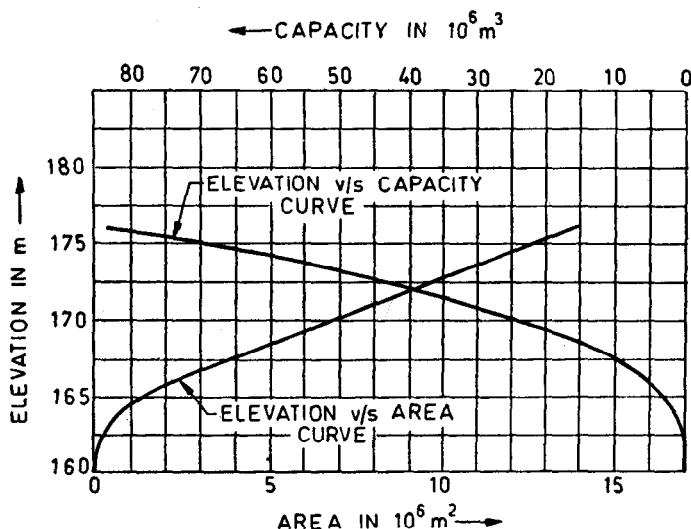


FIG. 1 AREA CAPACITY CURVE

4.14 Full Reservoir Level (F. R. L.)/Static Full Pool Level/Static Full Reservoir Level/Permanent Water Level or Full Supply Level — The highest reservoir level that can be maintained without spillway discharge or without passing water downstream through sluice-ways. It does not include any depth of surcharge.

4.15 Highest Controlled Water Level — The highest reservoir level up to which the outflow from the reservoir is planned to be controlled by operation of gates and outlets. For reservoir not having included surcharge operation, this corresponds to ' Full Reservoir Level '.

4.16 Highest Flood Level — See 4.23.

4.17 Inactive Capacity — Storage capacity, exclusive of dead storage, below which evacuation is not contemplated because of minimum irrigation and power load requirements or of operating agreements not to draw the reservoir below a given capacity or elevation for the relevant purposes.

4.18 Induced Surcharge Capacity — Capacity which is assigned to flood control purpose certain period of the year and to conservation purposes during other period of the year that is capacity available between the highest controlled water level and full reservoir level.

4.19 Joint Use Capacity (Flood Control and Conservation) — Capacity between the lowest of the seasonally fluctuating maximum rule curve level and the top of conservation pool level.

4.20 Live Capacity / Live Storage Capacity — Capacity available between dead storage level and full reservoir level.

4.21 Live Storage — Volume of water actually available at any time between dead storage level and the lower of actual water level and full reservoir level.

4.22 Maximum Rule Curve Level — The level up to which the storage accumulation for conservational purposes is allowed. This level can fluctuate seasonally and the highest of these seasonal levels will correspond to the top of conservation pool.

4.23 Maximum Water Level (M. W. L.) — The maximum water level likely to be attained in the reservoir at the dam face while negotiating the adopted design flood. (It also depends on the specified initial reservoir level and the spillway regulation rule.) Also called 'Highest Reservoir Level' 'Highest Floor Level'.

4.24 Maximum Water Surface Elevation — The level attained at any specified location in a reservoir while negotiating the adopted design flood. At the dam face this corresponds to maximum water level (*see* 4.23).

4.25 Minimum Draw Down Level (M. D. D. L.) — It is the lowest level at which the full release towards meeting the specified purpose is physically possible and allowable under operating instructions.

4.26 New Zero Elevation/Zero Elevation — The level up to which all the available capacity of the reservoir was or is expected to be lost due to progressive sedimentation of the reservoir, up to the specified time.

4.27 Over Year Storage — *See* 4.6.

4.28 Reservoir Factor — *See* 4.7.

4.29 Reservoir Rim — The boundary line corresponding to maximum water surface elevation.

4.30 Silt Storage — Storage designed for accumulation of silt in a reservoir both below and above dead storage level.

4.31 Storage — Volume of water available in the reservoir at any specified time and between specified levels.

4.32 Storage Cycle* — A period at the beginning and end of which the reservoir contents are the same. The period may vary from a few hours to years depending upon inflow and outflow rates.

4.33 Storage Equation — An axiom that the volume of inflow equals the volume of outflow plus or minus the change in storage.

4.34 Submerged Area — The area that gets under submergence with the formation of the reservoir corresponding to specified reservoir condition.

4.35 Surcharge Storage — Storage capacity between maximum operating level of a reservoir (or full reservoir level) and maximum water level.

4.36 Top of Conservation Pool Level — The highest water level permissible for storing water for conservation use, such as municipal supply, irrigation and power generation, but excluding flood control.

4.37 Total Storage Capacity/Gross Storage Capacity — Capacity below full reservoir level. It would correspond to the sum of Dead Storage Capacity and Live Capacity. It would also correspond to the sum of Dead Storage Capacity, Inactive Capacity and Active Storage Capacity.

4.38 Uncontrolled Storage — Reservoir storage not controlled by gates or other devices. Storage at any time above the Highest Controlled Water Level.

4.39 Usable Storage Capacity — *See 4.1.*

4.40 Useful Capacity — *See 4.1.*

4.41 Useful Storage Capacity — *See 4.1.*

5. TERMS RELATING TO SEDIMENTATION IN RESERVOIR

5.1 Density Currents — The gravity flow of a fluid through, under or over another similar fluid of different density. Also called, 'Stratified Flow' or 'Density Flow'.

5.2 Density Flow — *See 5.1.*

5.3 Bottom Set Beds — These are formed of the finer particles usually of silt and clay carried by the stream water in suspension. The particles settle very slowly in the entire bottom of the reservoir.

5.3.1 Foreset Beds — These are formed of the coarse sediment carried by the stream usually travelling on or near the stream bottom and deposited where the current is retarded as it flows out into the reservoir and are inclined downward in the direction of flow, the inclination increasing with coarseness of the sediment (*see Fig. 2*).

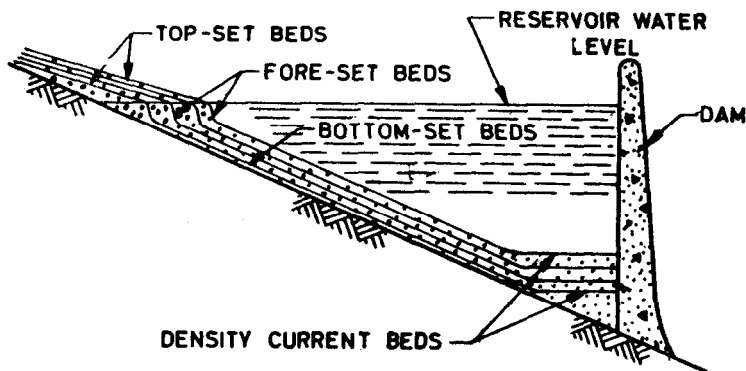


FIG. 2 LONGITUDINAL CROSS SECTION OF A RESERVOIR, SHOWING VARIOUS TYPES OF DEPOSITS

5.3.2 Topset Beds — These are usually composed of coarse sediments and are sloping at a low gradient from the edge of the foreset bed with a slightly increasing steepness upstream and extend as far as the back water curve extends upstream of the reservoir (see Fig. 2).

5.4 Inflow Density Currents — The density currents which flow through turbid media of varying density of similar fluid.

5.5 Inflow Turbidity Currents — Turbidity currents flowing between the lighter water and heavier water, for example, water in a reservoir at the surface is warmer and lighter and at bottom it is colder and heavier. This difference in densities of water will induce interflow turbidity currents in the reach where the interflowing water has a greater density overlying top water.

5.6 Overflow Density Currents* — Density currents which overflow another fluid.

5.7 Overflow Turbidity Currents* — Turbidity currents formed by the inflowing turbid water having lesser density than the water in the reservoir. The case occurs when the turbid water of the river enters the salt water (heavier) of the ocean. These currents can also occur with the water streams discharging into comparatively cold lakes.

5.8 Turbidity Currents* — A class of density currents associated with the suspension of sediment in the flowing water and usually involving the deposition of sediment in reservoirs.

5.9 Underflow Density Currents* — The density currents flowing under another fluid.

5.10 Underflowing Turbidity Currents* — The common type of density currents, which move down the bottom of a reservoir, lake or deep channel due to greater density of the turbid water resulting from the inclusion of suspended sediment.

5.11 Underflow Turbidity Currents

5.11.1 Underflow Turbidity Currents, Plunging Type* — The turbid water flowing into a reservoir plunging directly under the clear water in the lake. The formation of this type is indicated by the collection of flowing drift on the surface and the sharp line of separation of the muddy and the clear water (see Fig. 3).

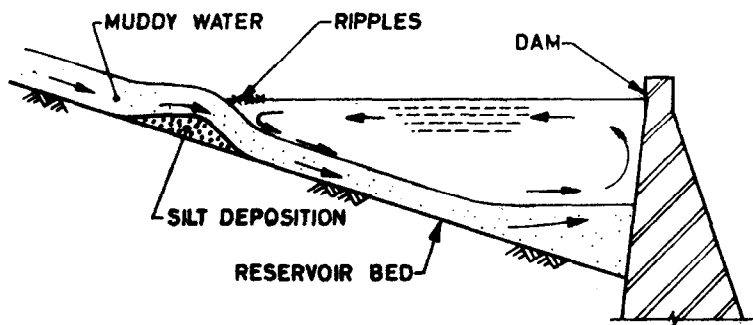


FIG. 3 UNDERFLOW TURBIDITY CURRENTS, PLUNGING TYPE

5.11.2 Underflow Turbidity Currents, Settling Type* — The flowing muddy water not diving under the clear water, but pushing it downstream and forms a considerable body of muddy water in which the sediment slowly settles to the bottom, which later on flows down into the reservoir as in the form of underflow turbidity currents. The existence of these currents is indirectly inferred from the deep deposit of fine materials in the stream bed near the upper ends of some large reservoirs (see Fig. 4).

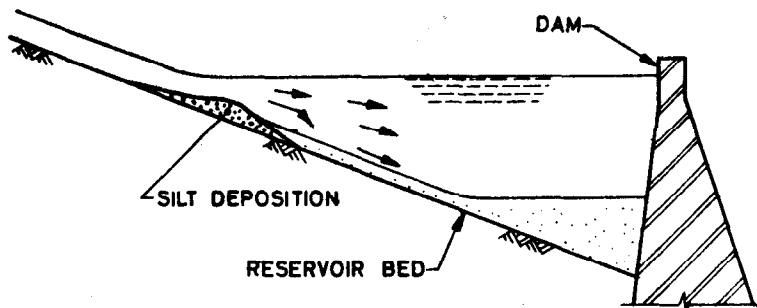


FIG. 4 UNDERFLOW CURRENTS, SETTLING TYPE TURBIDITY

6. TERMS RELATING TO EVAPORATION FROM RESERVOIR AND ITS CONTROL

6.1 Broadcast Method* — Spreading of dry powder of retardant on the water surface through dusting machine like grinder-spreader mounted on a boat which travels over the water surface, the powder spontaneously forms a protecting film; also called 'Dusting Method'.

6.2 Dispenser — The equipment used for spraying protective films to retard evaporation.

6.3 Dispensing Method* — A method of registering retardants to the water surface by first dissolving or emulsifying them in a volatile solvent which evaporates leaving the film of retardants behind on the water surface.

6.4 Dosage* — The quantity of the retardant substance required to form a monolayer on a unit of water surface in the first instance, or for subsequent regular replenishment of the film formed.

6.5 Dusting Method — *See* 6.1.

6.6 Evaporation

- 1) The process by which the water is changed from the liquid state to a gaseous state below the boiling point through the transfer of heat energy.
- 2) The quantity of water that is evaporated; the rate is expressed in depth of water, measured as liquid water, removed from a specified surface per unit of time generally in millimetre per day, month or year.

6.7 Evaporation Pan — An experimental tank used to determine the amount of evaporation from the surface of water.

6.8 Evaporation Rate — Quantity of water which is evaporated from a given water surface per unit of time.

6.9 Evaporation Retardants — Methods or measures of evaporation reduction from water surface, such as wind breaks, shading and protective films; also called 'Evaporation Retarders' or 'Evaporation Suppressor'.

6.10 Evaporation Retarders — *See* 6.9.

6.11 Evaporation Suppressors — *See* 6.9.

6.12 Feasible Service Time — For a specified purpose, the period or notional period for which the reservoir provided, or is/was expected to provide, a planned benefit to some extent of the reservoir being impaired

by sedimentation. Customarily, it is estimated as the time after which the 'New Zero Elevation' of the reservoir would equal the silt of the outlet relevant for the purpose.

6.13 Film Generation — The spreading of retardant chemical to form a monolayer on the water surface.

6.14 Film Generator* — A component of the dispenser containing the retardant and releasing it on the water surface for film generation.

6.15 Fixed Dispenser* — A dispensing equipment in which the retardant containers are located on the periphery of the water spread, which dispense the retardant through tubing, laid submerged in the reservoir and operated through hand contact valve and fitted with or without automatic wind controlled stopcocks; also called 'Shore Line Dispensing Unit' or 'Land Based Dispenser'.

6.16 Floating Dispenser* — Dispenser mounted on a boat or launch which moves through the water surface for dispensing the retardants.

6.17 Full Service Time — For a specified purpose, the period or notional period for which the reservoir provided or is/was expected to provide, the full planned benefit unaffected by the reason of sedimentation.

6.18 Land Based Dispenser — *See 6.15.*

6.19 Potential Evaporation — Quantity of water vapour which could be emitted by a surface of pure water, per unit surface area and unit time, in the existing condition.

6.20 Shore Line Dispensing Unit — *See 6.15.*

6.21 Surface Evaporation — Evaporation from the surface of water/snow or ice.

6.22 Suspension Process* — A patented method of application to water surface, in any manner of $C_{12} - C_{14}$ fatty alcohols of specified particle sizes in aqueous suspension or emulsion.

6.23 Wind Breaks — A barrier composed of planted trees, on the shores of reservoir designed to break the velocity of the wind over their water surface in order to reduce evaporation.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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